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Short-term effects of fire on the nematode community in a pine forest

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Summary. Before burning in winter 1990, the soil nematode community at two warm temperature pine forest sites consisted of 26–39% herbivores, 28–40% fungivores, 29% bacterivores, 3–4% omnivores, and 1% predators. Within six weeks after controlled burning, total numbers of omnivores and predators increased at one of two sites. Herbivores were little affected immediately after burning, except for *Belonolaimus*, which declined at one site. The fungivore *Aphelenchoides*, which was abundant in litter prior to burning, declined in soil after burning at both sites. Genera of several bacterivores showed short-term changes following burning. *Acrobeloides*, initially the most abundant bacterivore in soil, increased in abundance after burning at both sites. *Acrobeles* increased after burning, but *Alaimus*, *Anaplectus*, *Prismatolaimus*, and *Rhabditis* declined at one of two sites.

Key words: Soil nematodes; fire ecology; trophic groups; nematode abundance; pine forest, *Pinus elliottii*

Introduction

The importance of nematodes in decomposition and nutrient cycling is well established and recognized in many soil ecosystems (Freckman, 1988; Hendrix et al., 1986; Ingham et al., 1985; Popovici, 1984; Sohlenius, 1980). Populations of bacterivorous and fungivorous nematodes cycle and undergo species succession depending on the availability, C:N ratio, and degree of decomposition of organic substrate (Freckman, 1988; Wasilewska & Bienkowski, 1985). Efficient nutrient cycling is particularly critical in ecosystems such as forests receiving little or no input of supplementary fertilizer. Manipulations which alter the supply of nutrients and organic matter may directly or indirectly affect populations of many nematode genera present in the soil community. For example, in a pine (*Pinus sylvestris* L.) forest in Sweden, a combination of irrigation and fertilization increased abundance of some genera, such as *Rhabditis* and *Tylenchus* but had little effect on *Acrobeloides* and *Plectus* (Sohlenius & Wasilewska, 1984). Fertilization without irrigation decreased densities of *Acrobeloides* but did not affect *Tylenchus*. In Florida, preplant soil fumigation and fertilization enhanced early growth of slash pine (*Pinus elliottii* Engelm. var. *elliotii*) in a site with high levels of the plant-parasitic nematode *Meloidodera floridensis* Chitwood, Hannon, & Esser (Bengtson & Smart, 1981). Controlled burning of understory shrubs is a routine management practice in pine forests in the southeastern United States (Fahnestock, 1973, 1974), yet no information is available about its impact on soil nematode communities.

The present study was conducted to determine changes in nematode abundance in soil immediately after burning, compared to preburn population levels. An additional objective was to provide information on nematode community structure in a pine forest in the southeastern United States. Although nematode community structure has been studied in

more than 80 sites worldwide (Sohlenius, 1980), including several northern coniferous forests, no such information is available from pine forests in the southeastern United States. Available work on nematodes in this region has emphasized damage of pine seedlings by plant-parasitic species (Bengtson & Smart, 1981; Ruehle, 1966, 1967, 1969a, 1969b, 1973; Ruehle & Sasser, 1962).

Materials and Methods

Site description

The study sites were located about 1.5 km apart in Alachua County (Site A: 29°46'N, 82°11'W; Site B: 29°45'N, 82°11'W), about 20 km northeast of Gainesville, Florida. The climate is warm temperate, but not subtropical, with several frosts per year. Annual mean temperature (30-year average) is 20.9 °C (Thomas et al., 1985); average temperature October – March is 16.5 °C, and average April – September temperature is 25.5 °C. Annual mean precipitation is 1342 mm (Thomas et al., 1985). Precipitation averages 78 mm/month October – March and 142 mm/month April – September.

The soil type at both sites was Pomona sand (Sandy, siliceous, hyperthermic Ultic Haplaquods). Soil to 20 cm depth at Site A consisted of 91% sand, 6% silt, 3% clay, with pH = 5.05 and 2.0% organic matter. Soil at Site B was 92% sand, 5% silt, 3% clay, with pH = 4.45 and 2.8% organic matter. Soil at both sites contained an O horizon only 2 mm deep. Above this was a layer of fresh litter (2 – 3 cm deep) consisting mostly of pine needles.

Within each site, ten adjacent plots (each 10 m × 10 m) were established in a stand of 25-year-old slash pine *(Pinus elliotii)*. Tree density was 10 per 1000 m^2 in Site A and 22 per 1000 m^2 in Site B. Understory vegetation at both sites consisted mainly of saw plametto (*Serenoa repens* [Bartr.]) and gallberry holly (*Ilex glabra* [L.] Gray), with some fetterbush (*Lyonia lucida* [Lam.] K. Koch.) at Site A. The percent of each plot covered by each of these three understory plants was estimated on 16 January 1990. Open areas with scattered bracken fern (*Pteridium aquilinum* [L.] Kühn) occured in some plots. Understory vegetation and the fresh litter layer were destroyed in early February 1990 by a controlled burning which blackened tree trunks to a height of about 1 m at each site.

Sampling and extraction

The ten plots at each site were sampled on 16 January 1990 (preburn) and again on 28 March 1990 (postburn). Each plot was sampled separately, with a sample consisting of 12 cores (2.5-cm-diameter × 20-cm-deep) collected systematically throughout the 100 m^2 plot. The 12 cores comprising a sample were placed in a plastic bag, mixed, and stored at 10 °C for 2 – 3 days prior to extraction. A 100-cm^3 subsample was removed from each sample, and the nematodes extracted using a sieving and centrifugation technique (Jenkins, 1964). This passive extraction technique is less affected by storage temperature than active techniques involving Baermann funnels (Barker et al., 1969; McSorley and Walter, 1991).

On 16 January, litter samples were collected from each plot by removing all surface litter from six 10 cm × 10 cm locations within each plot. Litter samples were transported to the laboratory in plastic bags, and upon arrival, pine needles were cut into pieces 2 – 5 cm long. From each sample, a 16-g (fresh weight) subsample was incubated on a modified Baermann funnel (Rodriguez-Kabana & Pope, 1981) for 48 hr at 23 – 24 °C. No litter samples were collected on 28 March since only a 2-mm layer of ash remained on the soil surface following the fire.

All nematodes from each subsample were identified and counted at intermediate magnification (X150) on an inverted microscope. When identification was difficult, a specimen was examined *in situ* at higher magnification (X600).

Data analysis

The hypothesis that burning did not affect soil nematode populations was tested by comparing nematode numbers in soil before and after burning at each site by means of analysis of variance (Freed et al., 1987). Unless stated otherwise, only differences significant at $p \leq 0.05$ are discussed in the text.

Relationships between preburn nematode densities and existing understory vegetation were examined by computing (Freed et al., 1987) product-moment correlation coefficients (r) between percent of the plot covered by each plant species and the density of each nematode genus. Correlations of densities of omnivores or predators with densities of other nematode groups were also determined. Shannon's diversity index (H') (Shannon and Weaver, 1949) and eveness (J), where J = H'/maximum H' (Poole, 1974), were calculated to measure diversity among genera present in the soil or litter community at each location.

Nematode trophic groups

Assignment of nematode genera to trophic groups was similar to that in related literature (Freckman et al., 1979; Parmelee and Alston, 1986; Popovici, 1984; Sohlenius & Bostrom, 1986; Sohlenius & Wasilewska, 1984). Fungivores include those genera such as *Tylenchus* and *Aphelenchoides* which are also recognized as facultative root feeders (Sohlenius & Bostrom, 1986). Herbivores include all obligate root feeders or plant parasites. Predators include all Mononchida, as well as *Tobrilus* and *Tripyla* (Yeates, 1971). Omnivores consist of the Dorylaimida, although food habits of man of the nematodes in this group are unknown. Genera such as *Eudorylaimus* exhibit a wide rang of food habits (Yeates, 1971). The food habits of *Diphtherophora* are unclear (Parmelee & Alston, 1986), but Popovici (1984) and Sohlenius & Wasilewska (1984) have placed them as omnivores with the other dorylaimid genera.

Results

Effect of burning on nematode densities

Although densities of some bacterivorous nematode genera in soil were unaffected by burning, numbers of *Acrobeloides*, the most common bacterivore, increased following burning at both sites (Table 1). This resulted in an increase in total numbers of bacterivores at Site A but not at Site B. Effects of burning on other genera of bacterivores were inconsistent. Numbers of *Acrobeles* increased but numbers of *Alaimus*, *Anaplectus*, *Rhabditis*, and *Prismatolaimus* decreased at one site follwing burning, but were unaffected at the other site (Table 1). *Anaplectus*, *Eucephalobus*, and *Plectus* were relatively more abundant in the litter community than in soil (Table 2). Other bacterivores (Tables 1, 2) included occasional specimens of *Bunonema*, *Cephalobus*, *Cervidellus*, *Chronogaster*, *Monhystera*, *Pelodera*, *Teratocephalus*, and *Zeldia*, as well as those specimens which could not be identified to genus.

Herbivores were found only occasionally in litter (Table 2), and soil populations were affected little by burning (Table 1). *Belonolaimus* (a mixture of *B. euthychilus* Rau and *B. longicaudatus* Rau) decreased following burning at Site B but was not affected at Site A. Other herbivores included *Hoplolaimus*, *Criconemella*, *Paratylenchus*, and *Xiphinema*. Parallel declines in the latter three genera following burning at Site A resulted in a decrease in totals of these "other herbivores" at that site, although the individual decreases in each of these three genera were not significant.

Fungivores were abundant in the litter, with a single genus, *Aphelenchoides*, representing 73.5% and 65.6% of the total litter community at Site A and Site B, respectively (Table 2). *Aphelenchoides* comprised a much lower proportion of the soil community, and declined following burning at both sites (Table 1). The most abundant fungivore in soil was *Tylenchus*, which showed erratic distribution in plots following burning. Trends in increased abundance in *Tylenchus* and total fungivore numbers after burning were not significant due to the large standard errors associated with *Tylenchus* densities in the plots after burning (Table 1). Other fungivores recovered included occasional specimens of *Aphelenchus*, *Ditylenchus*, *Ecphyadophora*, and *Psilenchus*. Many Neotylenchidae, unidentifiable to genus, were found in the litter at Site B.

Total omnivores increased in soil following burning at Site A but not at Site B (Table 1). *Diphtherophora*, *Eudorylaimus*, and *Mesodorylaimus* showed significant increases in numbers

Table 1. Nematode abundance per 100 cm^3 soil before and after burning at two pine forest sites in Florida

Nematode genus	Site A		Site B	
	Preburn	Postburn	Preburn	Postburn
Bacterivores				
Acrobeles	0.9 ± 0.5	1.6 ± 0.3	0.3 ± 0.2	2.5 ± 0.7**
Acrobeloides	38.7 ± 7.2	73.4 ± 8.8**	21.2 ± 4.6	49.6 ± 8.5**
Alaimus	2.6 ± 0.7	4.3 ± 1.8	10.3 ± 2.4	1.9 ± 0.5*
Anaplectus	0	0.2 ± 0.2	1.0 ± 0.4	0.1 ± 0.1*
Eucephalobus	1.9 ± 0.4	0.9 ± 0.4	1.3 ± 0.4	2.8 ± 1.0
Plectus	0	0	0.2 ± 0.1	0
Prismatolaimus	1.9 ± 0.6	0.5 ± 0.3*	0.9 ± 0.4	0.7 ± 0.3
Rhabditis s. l.	17.8 ± 6.7	15.5 ± 2.7	13.6 ± 2.1	7.1 ± 1.3*
Wilsonema	2.6 ± 0.9	0.6 ± 0.4	1.0 ± 0.6	0.8 ± 0.8
Other bacteriovres	2.5 ± 0.5	2.9 ± 1.0	3.0 ± 0.8	1.5 ± 0.8
Total bacterivores	68.9 ± 8.8	99.9 ± 10.7*	52.8 ± 4.3	67.0 ± 9.7
Herbivores				
Aorolaimus	6.2 ± 1.7	17.9 ± 5.6	1.8 ± 1.0	1.9 ± 1.3
Belonolaimus	1.4 ± 0.5	0.9 ± 0.5	3.5 ± 0.6	0.4 ± 0.3***
Helicotylenchus	20.5 ± 4.0	51.3 ± 30.4	33.0 ± 5.8	40.3 ± 9.8
Hemicriconemoides	3.8 ± 1.2	2.4 ± 1.0	0.9 ± 0.6	2.1 ± 1.1
Hemicycliophora	18.5 ± 4.6	16.1 ± 5.0	19.9 ± 4.4	15.9 ± 3.5
Meloidodera	3.9 ± 0.8	2.9 ± 1.4	7.4 ± 1.0	4.2 ± 1.2
Paratrichodorus	1.3 ± 0.3	0.7 ± 0.4	0.7 ± 0.4	0
Pratylenchus	4.6 ± 1.5	3.0 ± 2.3	0.4 ± 0.2	0
Tylenchorhynchus s. l.	0.9 ± 0.5	1.8 ± 0.7	0.9 ± 0.6	0.3 ± 0.1
Other herbivores	1.7 ± 0.6	0.2 ± 0.2*	2.7 ± 1.8	0.3 ± 0.3
Total herbivores	62.8 ± 8.0	97.2 ± 31.3	71.2 ± 7.5	65.4 ± 9.4
Fungivores				
Aphelenchoides	2.7 ± 0.3	0.4 ± 0.3***	2.9 ± 0.8	0.7 ± 0.3*
Tylenchus	93.3 ± 5.6	130.9 ± 23.3	48.9 ± 8.6	169.1 ± 84.9
Other fungivores	0.3 ± 0.2	0.4 ± 0.2	0.5 ± 0.3	0
Total fungivores	93.6 ± 5.6	131.7 ± 23.4	52.3 ± 8.2	169.8 ± 84.8
Omnivores				
Diphtherophora	7.0 ± 1.1	12.1 ± 1.9*	1.8 ± 0.4	1.6 ± 0.3
Eudorylaimus	0.9 ± 0.4	4.3 ± 1.2*	2.7 ± 0.7	1.3 ± 0.4
Leptonchus	0	3.3 ± 2.1	0.7 ± 0.3	1.5 ± 0.6
Mesodorylaimus	1.3 ± 0.4	2.8 ± 1.4	0	1.3 ± 0.4**
Other omnivores	0	0.4 ± 0.2*	0.6 ± 0.4	0
Total omnivores	9.2 ± 1.4	22.9 ± 3.6**	5.8 ± 1.1	5.7 ± 0.8
Predators				
Mononchus	0.7 ± 0.3	1.8 ± 0.9	0.7 ± 0.5	0.4 ± 0.2
Tobrilus	0.9 ± 0.9	3.1 ± 1.0	0.1 ± 0.1	0.9 ± 0.4
Tripyla	0.4 ± 0.2	2.0 ± 1.2	0.7 ± 0.3	0.4 ± 0.2
Other predators	0.2 ± 0.1	1.0 ± 0.9	0	0
Total predators	2.2 ± 0.9	7.9 ± 2.4*	1.5 ± 0.7	1.7 ± 0.3
Total nematodes	236.7 ± 17.1	359.6 ± 55.4	183.6 ± 10.6	309.6 ± 94.5

Note: Figures are means ± standard errors of nematode numbers per 100 cm^3 soil from 10 plots from each site. Asterisks (*, **, ***) indicate that postburn levels differ from preburn levels for a given site at $p \leq 0.05$, $p \leq 0.01$, and $p \leq 0.001$, respectively

Table 2. Nematode abundance in 16-g litter samples before burning at two pine forest sites in Florida

Nematode genus	Site A	Site B
Bacterivores		
Acrobeles	0.1 ± 0.1	0.3 ± 0.2
Acrobeloides	3.8 ± 1.0	4.2 ± 1.1
Alaimus	0.9 ± 0.4	0.1 ± 0.1
Anaplectus	0.2 ± 0.2	2.8 ± 0.8
Eucephalobus	3.2 ± 0.8	7.7 ± 1.7
Plectus	0	5.7 ± 1.8
Rhabditis s. l.	1.3 ± 0.4	0
Wilsonema	1.1 ± 0.7	0.6 ± 0.3
Other bacterivores	0	2.0 ± 0.7
Total bacterivores	10.6 ± 2.1	23.4 ± 3.5
Herbivores		
Belonolaimus	0	0.3 ± 0.3
Meloidodera	0	1.1 ± 0.4
Pratylenchus	0	0.4 ± 0.2
Other herbivores	0	0.4 ± 0.3
Total herbivores	0	2.2 ± 0.6
Fungivores		
Aphelenchoides	142.7 ± 19.4	183.7 ± 17.4
Tylenchus	38.0 ± 9.3	44.5 ± 35.3
Other fungivores	0	13.7 ± 5.4
Total fungivores	180.7 ± 26.4	241.9 ± 41.4
Omnivores		
Eudorylaimus	1.7 ± 0.4	8.9 ± 1.6
Leptonchus	1.1 ± 0.6	2.8 ± 0.9
Total omnivores	2.8 ± 0.9	11.7 ± 2.3
Predators		
Mononchus	0	0.6 ± 0.3
Tobrilus	0	0.1 ± 0.1
Tripyla	0.1 ± 0.1	1.0 ± 0.4
Total nematodes	194.2 ± 27.5	280.2 ± 41.2

Note: Figures are means ± standard errors of nematode numbers per 16 g of litter from 10 plots from each site

following burning at one of two sites. Other omnivores recovered included unidentified dorylaims and a single specimen of *Pungentus*.
Predatory nematodes were rare (< 1% of community) in litter at both sites and in soil at Site B (Tables 1, 2). Increases in numbers of individual predaceous genera at Site A were not significant ($p \leq 0.05$), but total numbers of predators increased significantly following burning at this site. Other predators recovered included *Iotonchus*, *Mylonchulus*, and *Prionchulus*.

Community composition

Although fungivores dominated the litter fauna in terms of numbers (Table 3), fungivores, bacterivores, and herbivores each comprised ≥25% of the preburn soil communities at

Table 3. Percent composition of nematode community, number of genera identified, Shannon diversity index (H'), and evenness (J) for soil and litter samples from two pine forest sites in Florida

	Litter samples		Soil samples			
			Site A		Site B	
	Site A	Site B	Preburn	Postburn	Preburn	Postburn
% bacterivores	5.4	8.4	29.1	27.8	28.8	21.6
% herbivores	0	0.8	26.5	27.0	38.8	21.1
% fungivores	93.0	86.3	39.5	36.6	28.5	54.8
% omnivores	1.4	4.2	3.9	6.4	3.2	1.8
% predators	0.05	0.4	0.9	2.2	0.8	0.6
Number of genera	13	20	34	38	37	30
H'	0.87	1.25	2.15	2.11	2.36	1.59
J	0.34	0.42	0.61	0.58	0.65	0.47
Nematodes per m^2 ($x10^6$)†	—	—	0.48	0.73	0.37	0.63

Note: Figures on number of genera are for total number of genera identified from all 10 samples at each site and sampling time. † To a depth of 20 cm; converted from last line to Table 1

both sites. Omnivores and predators comprised a low percentage of the soil communities, but increased following burning at Site A. Number of genera recovered, Shannon diversity index (H'), and eveness (J) were all lower for litter communities than for soil communities (Table 3). H' and J were affected little by burning at Site A. Decreases in H' and J following burning at Site B are probably due to the extremely high densities of *Tylenchus* recovered in some plots.

Table 4. Correlation coefficients (r) between percent of plot covered by a given plant species and density of a given nematode genus per 100 m^3 soil, for preburn samples from two pine forest sites in Florida

Plant	Nematode	r
Site A		
Ilex glabra	*Diphtherophora*	+0.68
I. glabra	*Eucephalobus*	−0.84
I. glabra	*Tylenchorhynchus*	+0.75
I. glabra	Total omnivores	+0.65
Lyonia lucida	*Eudorylaimus*	+0.70
L. lucida	*Tylenchus*	−0.72
L. lucida	Total fungivores	−0.71
L. lucida	Total nematodes	−0.74
Serenoa repens	*Eucephalobus*	+0.69
Site B		
I. glabra	*Aphelenchoides*	−0.83
I. glabra	*Belonolaimus*	+0.74
I. glabra	*Helicotylenchus*	+0.78
I. glabra	Total nematodes	+0.80
S. repens	*Belonolaimus*	−0.81
S. repens	*Meloidodera*	−0.70

Note: Correlations are based on data from 10 plots (8 d. f.). Only correlations significant at $p \leq 0.05$ are shown

Correlation of nematodes with plant cover or predators

Prior to burning, understory vegetation was more heterogeneous at Site A (mean 31% of ground covered by *Serenoa repens*, 30% by *Ilex glabra*, 19% by *Lyonia lucida*, 21% open ground) than at Site B (44% covered by *S. repens*, 26% by *I. glabra*, 0% by *L. lucida*, 30% open ground). Prior to burning, occurrence and abundance of many nematode genera were roughly similar in both sites (Tables 1, 2). Some genera of herbivores, such as *Aorolaimus*, *Hemicriconemoides*, and *Pratylenchus*, were more abundant initially in Site A, with more diversity in vegetation, than in Site B. Omnivores and predators were also more common in Site A, but some genera of bacterivores, such as *Alaimus*, *Eucephalobus*, *Anaplecuts*, and *Plectus* were more common in the soil or litter at Site B than at Site A. Few significant ($p \leq 0.05$) or consistent correlations were found between nematode density and percent of a plot covered by understory plant species (Table 4).

Few significant negative correlations of nematode densities with densities of omnivores or predators were observed. At Site A before burning, *Eudorylaimus* densities were negatively correlated ($r = -0.66$) with total plant parasites, and before burning at Site B, total omnivores were inversely related to density of *Acrobeloides* ($r = -0.68$). After burning at Site B, *Tobrilus* was negatively correlated with total nematode density ($r = -0.70$). Many significant positive correlations of nematode densities with densities of omnivores or predators were observed (data not shown), particularly after burning (22 cases at Site A; 9 cases at Site B) and in litter samples (6 cases at Site A; 4 cases at Site B).

Discussion

Effects of burning on nematode community

Short-term changes are anticipated in densities of bacterivores, since they are so important in the initial stages of decomposition (Freckman, 1988; Wasilewska & Bienkowski, 1985) and increase following disturbance such as tillage (Parmelee & Alston, 1986). Densities of the most abundant bacterivore, *Acrobeloides*, doubled at both sites following burning, but other species declined. This probably results from changes in the quality and quantity of the bacterial food source available to different nematode genera before and after burning. The net effect was no significant change in total bacterivore density at Site B.

Densities of fungivores typically increase later than bacterivores in succession (Wasilewska & Bienkowski, 1985). No significant increases in fungivore densities in soil were observed here, at about 6 weeks after burning. Numbers of *Aphelenchoides* in soil declined at both sites, because of the destruction of the litter habitat in which it was very abundant. The feeding habits of genera as *Aphelenchoides* and *Tylenchus* are not well known, but they are usually classified as fungivores (Freckman et al., 1979; Parmele & Alston, 1986). Nevertheless it is recognized that they may also be facultative root feeders (Sohlenius & Bostrom, 1986) or, in the case of *Tylenchus*, may feed on sloughed root cells (Yeates, 1971). The abundance of both of these genera in pine needle litter in which roots were absent suggests that they may be feeding as fungivores in this system.

The saw palmetto, *S. repens*, tolerates burning, and incipient regneration of some leaves was observed in the postburn sampling. The shrubs *I. glabra* and *L. lucida* were destroyed, and their destruction could decrease the food supply available to herbivores. Possibly this would lead to declines in populations of species preferring these shrubs as food sources, although this was not generally observed in this short-term study. Possibly the decline of *Belonolaimus* following burning at Site B is related to the destruction of *I. glabra*, with which this genus was associated (Table 4).

The increased abundance of omnivores and predators following burning at Site A was unexpected, although densities of predatory spiders increased following a prairie fire in Wisconsin (Reichert & Reeder, 1972). Typically, the dorylaimids are considered "K-strategists", *i. e.* poor colonizers requiring stable habitats (Johnson et al., 1974). Rapid buildup after a disturbance is more characteristic of an "r-strategist" with a short generation time, such as *Acrobeloides*. In general, omnivores and predators showed positive rather than negative correlations with potential nematode prey, perhaps suggesting that an underlying factor such as habitat alteration or environmental conditions affected both predators and prey similarly.

With an interval of about 10 weeks between preburn and postburn samples, it is possible that some of the observed effects are seasonal, and not related to burning. More intensive sampling of undisturbed sites is needed to establish seasonal population fluctuations typical of pine forests in the southeastern United States. Nevertheless this study was conducted during the coolest time of the year, when nematode activity and population fluctuations were expected to be minimal. In pastures (Yeates, 1982, 1984) and forests (Yeates, 1972) sampled at monthly intervals, nematode densities did not change much over the three coolest months of the season (January – March in Northern Hemisphere, June – August in Southern Hemisphere) in each instance.

Comparison of nematode communities with other locations

A comparison of the preburn study sites A and B with selected studies from pine forests in other locations showed that the communities reported here and communities from pine forests in Poland (Wasilewska, 1971) had fairly similar composition. One of the sites in Poland consisted of pine (*Pinus sylvestris* L.) of similar age to those in this study, but with several deciduous tree species also present, and contained 41% bacterivores, 24% herbivores, 28% fungivores, 5% omnivores, and 1% predators. A site with 135-year-old pines contained 46% bacterivores, 26% herbivores, 25% fungivores, 2% omnivores, and 0% predators (Wasilewska, 1971). The percentage of bacterivores was somewhat higher and the percentage of fungivores was somewhat lower in the Poland sites than in the sites reported here (Table 3). In Swedish pine forests (Sohlenius, 1980; Sohlenius & Wasilewska, 1984) the percentage of bacterivores was even higher than in Poland (56% – 77% bacterivores).

Furthermore, total numbers of nematodes may be relatively low in the Florida sites. The soil storage and extraction methods used here are among the most efficient for this region and soil type (Barker et al., 1969; McSorley, 1987), but it is difficult to compare nematode densities among various studies because extraction methods differ (McSorley, 1987; Sohlenius, 1980). Nevertheless estimates of total numbers of nematodes per m^2 in soil to a 20-cm depth (Table 3) averaged only 0.42×10^6 before burning and 0.68×10^6 after burning. These numbers are at the lower end of the ranges in total density reported for most ecosystems studied (Sohlenius, 1980). For instance, a mean of 3.33×10^6 and range of 1.12×10^6 to 15.0×10^6 for total nematode density is reported from 14 northern coniferous forest sites (Sohlenius, 1980). Data from warm temperate and tropical ecosystems are sparse, but recent evidence (Yeates, 1991) suggests that total nematode numbers of hundreds of thousands (rather than millions) per m^2 are more typical of those expected in soil ecosystems in warmer climates. In the sites studied here, both numbers and percent bacterivores were lower than those found in northern coniferous forests. The implications of the lower numbers of bacterivores in the Florida ecosystem are unclear. Because of the warmer soil temperatures, metabolic activity may be increased and generation times of bacterivores may be shorter, but further research is needed to learn if more rapid nutrient turnover could compensate for turnover by larger numbers of bacterivores. Little is known about nutrient cycling by nematodes in southern pine forests or about the impact of fire on nutrient cycling.

Conclusion

Burning of understory vegetation in a warm temperate pine forest had varied effects on the soil nematode community. Burning had little immediate effect on nematode genera which feed directly on roots of higher plants. Densities of some genera of bacterivores increased and others decreased immediately after burning, possibly due to changes in the composition of the bacterial flora following burning. Consistent reduction of *Aphelenchoides* in soil following burning probably resulted from destruction of the litter habitat in which the nematode was abundant.

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